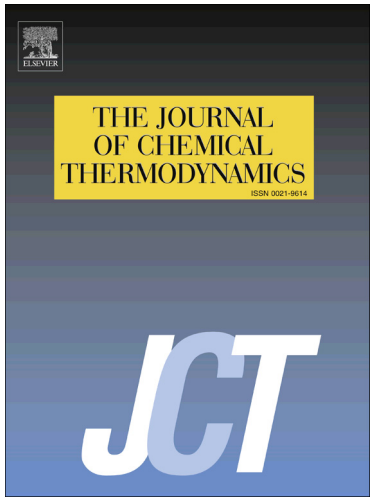

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Viscosity of CO_2-rich mixtures from 243 K to 423 K at pressures up to 155 MPa: new experimental viscosity data and modelling

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ABSTRACT

The viscosities of three multi-component CO_2-rich mixtures were measured using the classical capillary tube technique. The tests were conducted at pressures from 1 to 155 MPa at various temperatures from 243 to 423 K in the gas, liquid and supercritical regions. Correlative and predictive models were evaluated using the measured experimental viscosity data. The correlative model, i.e., Lohrenz-Bray-Clark (LBC) model, was tuned to match the experimental data (CO_2-LBC after tuning) and predictive models were modified by replacing the reference fluids. The predictive models in this work are based on the corresponding states (CS) theory models. The one reference fluid corresponding states model is the model originally developed by Pedersen which was modified by changing the reference fluid from methane to CO_2 (called hereafter to CO_2-Pedersen); two reference fluid corresponding states model is the Aasberg-Petersen (CS2) approach which was modified by selecting CO_2 as reference fluid for CO_2-rich fluids instead of n-decane which is suitable for hydrocarbons (CO_2-CS2 model). The SUPERTRAPP predictive model, based on the extended corresponding states (ECS) theory, was also modified by changing the reference fluid propane to carbon dioxide (CO_2-SUPERTRAPP). Comparisons for the investigated mixtures show that the overall Absolute Average Deviation (AAD) for the CO_2-Pedersen, CO_2-SUPERTRAPP, CO_2-CS2 and CO_2-LBC are 3.8%, 4.6%, 5.3% and 9.2%, respectively. Overall, the CO_2-Pedesen viscosity model is the most accurate model when predicting the viscosity of the investigated CO_2-rich mixtures. As the viscosity is a function of density, the effect of the mixture density on the mixture viscosity was investigated. Also, the viscosity reduction of pure CO_2 due to the presence of impurities in each system was demonstrated.